

CLAIMS:

1. A method for detecting a desired signal in an electromagnetically noisy environment, the method  
5 comprising:

detecting electromagnetic signals comprising a noise signal and the desired signal;

compressing the detected electromagnetic signals to generate a compressed signal;

10 filtering the compressed signal to generate a filtered signal comprising substantially the desired signal; and

expanding the filtered signal.

2. The method of Claim 1 wherein the desired  
15 signal is a known signal.

3. The method of Claim 1 wherein the desired signal is a signal on a metallic conductor.

4. The method of Claim 1 wherein the step of detecting electromagnetic signals is performed by a first  
20 antenna, and wherein the method further comprises:

detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and

inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal  
25 detected by the first antenna for the step of compressing.

5. The method of Claim 1 further comprising the step of amplifying the compressed signal.

6. The method of Claim 1 further comprising the step of generating an audible sound indicative of the  
5 expanded signal.

7. The method of Claim 1 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter  
10 connected in parallel with the first filter and expandor.

8. An apparatus for detecting a desired signal in electromagnetically noisy environments, the apparatus comprising:

an antenna configured to detect electromagnetic  
15 signals comprising a noise signal and the desired signal;

an electronic signal compressor electrically connected to the antenna and configured for compressing the electromagnetic signals to thereby generate a compressed signal;

20 a bandpass filter connected to the compressor for receiving the compressed signal from the compressor and configured for generating a filtered signal comprising substantially the desired signal; and

25 an electronic signal expandor connected to the bandpass filter and configured for expanding the filtered signal.

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9. The method of Claim 8 wherein the desired signal is a known signal.
10. The method of Claim 8 wherein the desired signal is a signal on a metallic conductor.
- 5       11. The apparatus of Claim 8 wherein the antenna is a first antenna, and the apparatus further comprises:  
          a second antenna configured for detecting electromagnetic signals comprising substantially the noise signal; and
- 10      an amplifier connected to the compressor, first antenna, and second antenna, the amplifier being configured for inverting the signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna.
- 15      12. The apparatus of Claim 8 wherein the antenna is a first antenna, and the apparatus further comprises:  
          a second antenna configured for detecting electromagnetic signals comprising substantially the noise signal; and
- 20      a differential amplifier connected to the compressor, first antenna, and second antenna, the amplifier being configured for inverting the signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna.
- 25      13. The apparatus of Claim 8 further comprising a gain controller configured for adjusting amplitude of the compressed signal.

14. The apparatus of Claim 8 further comprising an amplifier and speaker connected to the expandor for generating an audible sound indicative of the expanded signal.

5       15. The apparatus of Claim 8 further comprising a tick generator connected to a speaker, the tick generator being configured for periodically generating a tick signal for output through the speaker to indicate that the apparatus is powered on and in a mode of operation.

10       16. The apparatus of Claim 8 wherein the bandpass filter is a first bandpass filter, and wherein the apparatus further comprises:

            a second bandpass filter connected in parallel with the first bandpass filter and expandor; and

15       means for controlling whether the compressed signal is directed through the first bandpass filter or the second bandpass filter.

20       17. An apparatus for detecting a signal in an electromagnetically noisy environment, the apparatus comprising:

            a probe antenna configured to detect electromagnetic signals comprising a noise signal and the tone signal;

25       a noise canceling antenna configured for detecting electromagnetic signals comprising substantially the noise signal;

            an amplifier connected probe antenna and noise canceling antenna, the amplifier being configured for inverting the signal detected by the noise canceling

antenna, and outputting an amplified signal comprising the sum of the inverted signal and the signal detected by the probe antenna;

an electronic signal compressor electrically  
5 connected to the amplifier for receiving the amplified signal, and configured for compressing the amplified signal to thereby generate a compressed signal;

a bandpass filter connected to the compressor for receiving the compressed signal from the compressor and  
10 for substantially filtering out the noise signal and outputting a filtered signal comprising substantially the known signal and insubstantially the noise signal;

an electronic signal expandor connected to the bandpass filter and configured for receiving the filtered  
15 signal and generating an expanded signal comprising substantially the known signal amplifying and attenuating substantially the noise signal of the filtered signal;  
and

a speaker connected to the expandor for generating  
20 an audible sound indicative of the expanded signal.

18. The method of Claim 17 wherein the known signal is a known signal on a wire.

19. The apparatus of Claim 17 wherein the amplifier is a differential amplifier.

25 20. The apparatus of Claim 17 further comprising a gain controller interconnected between the compressor and bandpass filter and configured for adjusting the amplitude of the compressed signal.

21. The apparatus of Claim 17 further comprising a tick generator connected to a speaker, the tick generator being configured for periodically generating a tick signal, and the speaker being configured for making the  
5 tick signal audible to indicate that the apparatus is powered on and operating in a mode of operation utilizing an expander.

22. The apparatus of Claim 17 wherein the bandpass filter is a first bandpass filter, and wherein the  
10 apparatus further comprises:

a second bandpass filter connected in parallel with the first bandpass filter and expandor; and  
means for controlling whether the compressed signal is directed through the first bandpass filter or the  
15 second bandpass filter.

23. A method for detecting a desired signal in an electromagnetically noisy environment, the method comprising:

detecting electromagnetic signals comprising a noise  
20 signal and the desired signal;

compressing the detected electromagnetic signals to generate a compressed signal;

filtering the compressed signal to generate a filtered signal comprising substantially the desired  
25 signal.

24. The method of Claim 23 wherein the desired signal is a known signal.

25. The method of Claim 23 wherein the desired signal is a signal on a metallic conductor.

26. The method of Claim 23 wherein the step of detecting electromagnetic signals is performed by a first antenna, and wherein the method further comprises:

detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and  
inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna for the step of compressing.

27. The method of Claim 23 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter connected in parallel with the first filter.

28. A method for detecting a desired signal in an electromagnetically noisy environment, the method comprising:

20        detecting electromagnetic signals comprising a noise signal and the desired signal;  
              filtering the detected electromagnetic signals to generate a filtered signal comprising substantially the desired signal; and

25        expanding the filtered signal.

29. The method of Claim 28 wherein the desired signal is a known signal.

30. The method of Claim 28 wherein the desired signal is a signal on a metallic conductor.

31. The method of Claim 28 wherein the step of detecting electromagnetic signals is performed by a first antenna, and wherein the method further comprises:

detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and  
inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna for the step of filtering.

32. The method of Claim 28 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter connected in parallel with the first filter.

33. A method for detecting a desired signal in an electromagnetically noisy environment, the method comprising:

detecting with a first antenna electromagnetic signals comprising a noise signal and the desired signal;  
detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and  
inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna to generate a summed signal.

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34. The method of Claim 33, further comprising:  
compressing the summed signal to generate a  
compressed signal;  
filtering the compressed signal to generate a  
5 filtered signal comprising substantially the desired  
signal; and  
expanding the filtered signal.

35. The method of Claim 33, further comprising:  
filtering the summed signal to generate a filtered  
10 signal comprising substantially the desired signal; and  
expanding the filtered signal.

36. The method of Claim 33, further comprising:  
compressing the summed signal to generate a  
compressed signal; and  
15 filtering the compressed signal to generate a  
filtered signal comprising substantially the desired  
signal.

37. The method of Claim 33, further comprising:  
compressing the summed signal using digital signal  
20 processing (DSP) to generate a compressed signal;  
filtering the compressed signal using DSP to  
generate a filtered signal comprising substantially the  
desired signal; and  
expanding the filtered signal using DSP.

38. The method of Claim 33, further comprising:  
filtering the summed signal using digital signal  
processing (DSP) to generate a filtered signal comprising  
substantially the desired signal; and  
5 expanding the filtered signal using DSP.

39. The method of Claim 33, further comprising:  
compressing the summed signal using digital signal  
processing (DSP) to generate a compressed signal; and  
filtering the compressed signal using DSP to  
10 generate a filtered signal comprising substantially the  
desired signal.

40. The method of Claim 33 wherein the desired  
signal is a known signal.

41. The method of Claim 33 wherein the desired  
15 signal is a signal on a metallic conductor.

42. A method for detecting a desired signal in an  
electromagnetically noisy environment, the method  
comprising:

detecting electromagnetic analog signal comprising a  
20 noise signal and the desired signal;  
converting the analog signal into a digital signal;  
compressing the digital signal using digital signal  
processing (DSP) to generate a compressed signal;  
filtering the compressed signal using DSP to  
25 generate a filtered signal comprising substantially the  
desired signal;

expanding the filtered signal using DSP to generate an expanded digital signal; and

converting the expanded digital signal to an analog signal.

5       43. The method of Claim 42 wherein the desired signal is a known signal.

44. The method of Claim 42 wherein the desired signal is a signal on a metallic conductor.

10      45. The method of Claim 42 wherein the step of detecting electromagnetic signals is performed by a first antenna, and wherein the method further comprises:

detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and

15      inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna for the step of compressing.

46. The method of Claim 42 further comprising the step of amplifying the compressed signal.

20      47. The method of Claim 42 further comprising the step of generating an audible sound indicative of the expanded signal.

48. The method of Claim 42 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter  
5 connected in parallel with the first filter and expandor.

49. A method for detecting a desired signal in an electromagnetically noisy environment, the method comprising:

- detecting electromagnetic analog signals comprising  
10 a noise signal and the desired signal;
- converting the analog signals into a digital signal;
- compressing the digital signal using digital signal processing (DSP) to generate a compressed signal;
- filtering the compressed signal using DSP to  
15 generate a filtered signal comprising substantially the desired signal.

50. The method of Claim 49 wherein the desired signal is a known signal.

51. The method of Claim 49 wherein the desired  
20 signal is a signal on a metallic conductor.

52. The method of Claim 49 wherein the step of detecting electromagnetic analog signals is performed by a first antenna, and wherein the method further comprises:

- 25 detecting with a second antenna electromagnetic analog signals comprising substantially the noise signal;  
and

inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal detected by the first antenna for the step of compressing.

5       53. The method of Claim 49 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter connected in parallel with the first filter.

10      54. A method for detecting a desired signal in an electromagnetically noisy environment, the method comprising:

detecting electromagnetic analog signals comprising a noise signal and the desired signal;

15      converting the analog signals into a digital signal;  
filtering the digital signal using digital signal processing (DSP) to generate a filtered signal comprising substantially the desired signal; and  
expanding the filtered signal using DSP.

20      55. The method of Claim 54 wherein the desired signal is a known signal.

56. The method of Claim 54 wherein the desired signal is a signal on a metallic conductor.

25      57. The method of Claim 54 wherein the step of detecting electromagnetic signals is performed by a first antenna, and wherein the method further comprises:

detecting with a second antenna electromagnetic signals comprising substantially the noise signal; and

inverting the noise signal detected by the second antenna, and summing the inverted signal to the signal  
5 detected by the first antenna for the step of filtering.

58. The method of Claim 54 wherein the filter is a first filter, and wherein the method further comprises controlling whether the compressed signal is directed through the first filter or through a second filter  
10 connected in parallel with the first filter.

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